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THE EFFECTS OF MODELING AND FEEDBACK VARIABLES ON THE ACQUISITION OF A COMPLEX TEACHING STRATEGY.

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THE RELATIVE EFFECTIVENESS OF SIX MODES OF TRAINING TEACHERS TO USE PROBING QUESTIONS WAS INVESTIGATED. THE MODES INVOLVED SYMBOLIC MODELING, PERCEPTUAL MODELING, OR BOTH, COUPLED WITH FEEDBACK. AFTER RATINGS OF PERTINENT BEHAVIOR IN A 5-MINUTE LESSON WERE COLLECTED AS PRETRAINING MEASURES, STANFORD TEACHER INTERNS WERE RANDOMLY DISTRIBUTED AMONG 6 TRAINING GROUPS, WHOSE EXPECTED EFFECTIVENESS, IN INCREASING ORDER, WAS--(1) MINIMUM SYMBOLIC MODELING (SAW PRETEST VIDEOTAPE PLAYBACK ALONE, STUDIED WRITTEN INSTRUCTIONS, PLANNED, AND RETAUGHT), (2) MAXIMUM SYMBOLIC MODELING (SAW PLAYBACK WITH EXPERIMENTER WHO GAVE CUES AND REINFORCEMENT, STUDIED WRITTEN INSTRUCTIONS, PLANNED, AND RETAUGHT), (3) MINIMUM PERCEPTUAL MODELING (SAW PLAYBACK AND PERCEPTUAL MODEL ALONE, PLANNED, AND RETAUGHT), (4) STRONG SYMBOLIC AND MAXIMUM PERCEPTUAL MODELING (SAME AS 2 BUT ALSO VIEWED PERCEPTUAL MODEL ALONE), (5) MAXIMUM PERCEPTUAL MODELING (VIEWED PLAYBACK ALONE BUT SAW PERCEPTUAL MODEL WITH EXPERIMENTER), (6) STRONG SYMBOLIC AND MAXIMUM PERCEPTUAL MODELING (SAW PLAYBACK AND PERCEPTUAL MODEL WITH EXPERIMENTER). EACH TAPE WAS RATED FOR RELEVANT BEHAVIOR BY 2 TRAINED RATERS. THESE EXPECTATIONS WERE LARGELY CONFIRMED, (EXCEPT MODE 4 DID BETTER THAN MODE 3) WITH PERCEPTUAL MODELING APPEARING SUPERIOR TO SYMBOLIC. (AF)

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~~EXPERIMENT III.~~

THE EFFECTS OF MODELING AND FEEDBACK VARIABLES ON THE ACQUISITION OF A COMPLEX TEACHING STRATEGY

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THE EFFECTS OF MODELING AND FEEDBACK VARIABLES ON THE ACQUISITION OF A COMPLEX TEACHING STRATEGY

The purpose of this study was to assess the relative effects of various arrangements of feedback and presentation variables upon the performance of a specified class of teacher behaviors.

Definition of the Problem: A common approach to the transmission of teaching skills has been to provide some kind of discrimination training by means of written and oral instructions. The intern teacher typically receives a description of the correct responses and their sequencing for a particular situation. He then attempts to produce these behaviors in the classroom and receives periodic feedback on his performance.

Another approach to training problems of this sort is suggested by recent findings on the role of observational learning in personality development. A review of the relevant literature by Bandura and Walters (1963) has shown that complex social behavior may be acquired almost entirely through imitation. They state that the provision of face-to-face models serves to accelerate the learning process and, in cases where errors are dangerous or costly, become an essential means of transmitting behavior patterns (Bandura and Walters, 1963, p.52). In addition, Bandura, Ross and Ross (1963) have demonstrated that film-mediated models are as effective as real-life models in transmitting deviant patterns of behavior.

One of the objectives of the study was to compare these two modes of presentation in the context of a televised series of training sessions for intern teachers. The experimental design permitted an analysis of the assumption that the rate and level of learning a given teaching skill varies as a function of the mode of model presentation. Two types of modeling were considered: (1) Symbolic Modeling: This is defined as a process whereby one transmits desired behaviors to the learner by means of written or verbal instructions. The subject

does not view an actual portrayal of the desired behavior. (2) Perceptual Modeling: This is defined as a process whereby one transmits desired behaviors to the learner by means of a filmed model who portrays the desired behavior.

While the experimental literature suggests that both modeling and feedback effectively change behavior, little is known about the relative effectiveness of these two processes. The human learner, because of his considerable information-processing capacities, may require little feedback when the desired behaviors are portrayed as in perceptual modeling. However, when the responses to be learned are sufficiently complex, some combination of demonstration and feedback may be required.

The purpose of the study then was twofold. In addition to permitting a comparison of symbolic and perceptual modeling, the experiment was designed to assess the relative effects of various arrangements of feedback in combination with the two presentation variables. In general, the experiment sought to determine which would be more efficient; telling the person what to do (symbolic modeling), or showing him what to do (perceptual modeling), or some combination of these approaches with feedback that includes reinforcement and further discrimination training on the relevant cues.

It was predicted that perceptual modeling would be a more efficient training procedure than symbolic modeling, and that a combination of the two types of modeling would be more effective than either form of treatment by itself. Perceptual modeling procedures permit the display of a large number of the desired responses. They enable one to increase the distinctiveness of relevant stimuli by training the model to emit such behaviors clearly, and in training sessions enable an experiment to further highlight them by prompting techniques. It is suggested that the perceptual adequacy of such modeling facilitates the development of perceptual blueprints (Sheffield, 1961) which serve to unify discrete elements of the desired skill.

Perceptual and Symbolic Modeling as Feedback Procedures: Given: a training scheme in which the subject is first exposed to one of the two types of modeling, then practices the modeled behaviors, and following this is exposed to the appropriate type of modeling for the second time. Clearly the two types of modeling act as presentation variables in initial training. However, when presented for the second time, they must be viewed as feedback procedures. Viewed in this way, it would appear that perceptual modeling as a feedback device can best be described as a form of prompting feedback. Symbolic modeling on the other hand should be viewed as confirmation feedback.

The introduction of discrimination training associated with either a perceptual model or a playback of the subject's practice session further highlights this distinction. In providing discrimination training based on the subject's prior performance, differential reinforcement by the experimenter necessarily becomes the prepotent technique for increasing the distinctiveness of relevant cues. Suggestions for improvements in future performance must also be based on prior performance, and thus they too assume a confirmatory quality.

One might suggest that because confirmation feedback is based directly on the subject's performance, it has greater immediacy and therefore should be more effective than model-based feedback. On the other hand, research by Cook and Kendler (1956), Cook (1958), and Angell and Lumsdaine (196la; 196lb) would imply that prompting procedures would be more effective. The prediction here was that prompting feedback would be more effective than either confirmation or self-feedback, and that a combination of prompting and confirmation feedback would lead to great increases in the response strength of a specified teacher skill than any of the three feedback procedures alone.

METHOD

The Dependent Variable: The dependent variable that was developed for the study is termed probing. Since a description of the technique has already appeared elsewhere (Allen, McDonald and Orme, 1966), comments here will be brief.

Probing is a basic questioning technique in which the teacher requires students to go beyond first-answer responses. It is designed to be used in lessons where pupil participation is prerequisite to the goals of instruction, and is intended to upgrade the quality of such participation. Once the pupil has responded by means of a question, answer, or comment, the teacher may probe this response by means of one or more probing techniques. These sub-classes or categories of probing are termed: clarification, increased critical awareness, refocus, prompting, encouraging alternatives, and redirection. The labels in each case generally reflect the teacher's goal when using a given type of probing. The techniques are statistically independent, and have been developed to underscore the fact that a variety of probing techniques are required for different types of pupil responses.

General Procedure: A two by three design matrix that permitted an assessment of the relevant combinations of presentation and feedback variables yielded six experimental groups. The treatment procedure for each group was broken down into ten steps or stages (See Table 1, Experiment III). In six of these steps all groups received identical treatment. In the remaining four, each group was exposed to the appropriate type of modeling and a particular type of feedback.

In the first step all subjects were videotaped while teaching a five-minute lesson to four junior high school students. This constituted the pretest from which baseline levels of probing were derived.[1] Following this set induction process, the groups were exposed to the appropriate types of modeling in the next two steps. In steps five and six, all subjects planned and then taught a second five-minute lesson. The cycle was then repeated except that the set induction process in step two was dropped. Note that in viewing the appropriate model for the second time, the subject was receiving a feedback treatment.

In terms of general procedure then, all subjects were pretested, received written instructions, were exposed to the appropriate modeling procedure, and following a planning

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[1] Five minute lessons were employed throughout the study. The rationale for this "microteaching" format derives from two considerations. First, Margoliues and Sheffield (1961) found that in training film research, a four to five minute film segment turned out to be the optimal Demonstration-Attention segment for college-age military subjects. Secondly, the five minute lesson provides ample opportunity for the intern or perceptual model to demonstrate a satisfactorily high number of probes for measurement purposes.

session they taught for the second time. This means that before his treatment was complete, each subject had been exposed to the appropriate modeling and feedback treatments, and had taught three times. To avoid undue attention being paid to the development of a new lesson each time, the subjects taught a different group of students in each lesson. This allowed them to retain the same basic subject matter in each lesson while attending to improvements in probing techniques. The experiment was run over a six-week period as part of the regular intern program. Each subject spent approximately two hours in total treatment.

Treatments: As mentioned earlier, six experimental groups received differential treatments. Four groups viewed perceptual models at some point in their treatment, and two received symbolic modeling. In terms of the assumption that the rate and level of learning a given teaching skill varies as a function of the model of model presentation, the experimental groups were set up in such a way that on the basis of the rationale outlined earlier, one would expect systematic increase in probing over non-probing from Group 1 through Group 6, by the end of the second teaching session.

To facilitate subsequent discussion, the groups will be identified by the kind of modeling they initially received. The overall treatment for each group will be considered in terms of presentation variables. Following this, feedback procedures will be discussed. A summary of the following discussion appears in Table 1. (See Table 1, Experiment III)

Presentation Treatments: Group 1 (Minimal Symbolic Modeling): Following the pretest and set induction through written materials, Group 1 subjects viewed a videotape playback of their pretest performance alone. Then they were directed to study the written materials on the criterion behavior for a second time. In subsequent steps they planned and taught again, then viewed a playback of their second lesson, reread the instructions once more and taught a third session. Note that this is a symbolic modeling group. While they received written instructions, no verbal instructions; i.e., discrimination training, was provided by E. This group was thus termed a minimal symbolic modeling treatment group.

Group 2 (Maximal Symbolic Modeling): Following the first two steps, subjects in this group viewed a videotape playback of their pretest performance with E. As in all treatment steps where he viewed a tape with the subject, E verbally reinforced the desired responses when they occurred during the playback. In addition he identified salient cues to which the desired behavior should be attached, made suggestions about variations in the form of the desired behavior, and pointed out the effects of such behavior on pupil behavior. Following the playback

with E, Group 2 subjects were directed to study the written materials for a second time. then, after a planning and teaching session, the cycle was repeated.

Group 3, (Minimal Perceptual Modeling): Following the first two steps, subjects in the third group viewed a videotape playback of their pretest performance alone, In the next step they viewed a perceptual model alone. As in all treatment steps where subjects viewed a perceptual model, Group 3 interns were presented with a model teacher who was of the same sex as the subject, and who demonstrated probing in a subject matter area which corresponded to the intern's major field of interest. Cnce Group 3 subjects had viewed the model alone they planned and then taught the second lesson. The cycle was then repeated. Group 3 were defined as a minimal perceptual modeling treatment group.

Group 4 (Strong Symbolic and Maximal Perceptual Modeling): Like Group 2, this group received both discrimination training and reinforcement from E while viewing videotape playbacks of their own performance. In the next step, subjects viewed the appropriate perceptual model alone. This treatment thus combined strong symbolic with minimal perceptual modeling.

Group 5 (Maximal Perceptual Modeling): This treatment differed from all others in that subjects viewed playbacks of their own performance alone, but viewed the appropriate perceptual model with E. E's verbal output was keyed on the perceptual model's behavior rather than on the subject's performance. This mode of treatment was termed maximal perceptual modeling because subjects received discrimination training from E based directly on salient modeling cues.

Group 6 (Strong Symbolic and Maximal Perceptual Modeling): Subjects in the appropriate treatment stages viewed playbacks of their own performance with E, and then viewed the appropriate perceptual model with E. The condition was thus one of strong symbolic and maximal perceptual modeling.

Feedback Treatments: By definition, all subjects received feedback treatments when they were exposed to the appropriate form of modeling for the second time. The second presentation of the perceptual model was defined as prompting feedback, and symbolic modeling became a form of confirmation feedback. The experimenter's function, when he viewed a tape with the subject, was precisely the same as in the earlier phases of treatment. The relationship of each of these forms of feedback to the six experimental groups is outlined in Table 2. (See Table 2, Experiment III) Groups 1 and 2 did not view both the model and

their own playbacks, and thus received only partial feedback. For this reason they were not considered as one of the four basic groups in the analysis of feedback effects. Note that in terms of the postulated differences between the four types of feedback, one would expect systematic increases in probing over non-probing from Group 3 to Group 6, the latter group demonstrating the greatest gains by the end of the third teaching session.

Subjects: Subjects were drawn from the Stanford Intern Teacher population. Prior to random assignment to the six groups, they were categorized by subject-matter major. From these subgroups, the interns were then assigned to one of the six treatment conditions. Relevant characteristics of the population studied appear in Table 3. (See Table 3, Experiment III) T statistic analyses were run on each of these variables, and proved to be non-significant.

Training Procedures for Models: Experienced teachers were selected to act as perceptual models. One model of each sex from each of the major subject-matter areas was trained to demonstrate probing techniques in a five-minute lesson. The conditions under which both models and subjects taught were identical.

One week prior to taping and training, potential models were given an outline of probing procedures. In the training session they taught the same lesson to different groups of students until criterion was reached. The investigator set a lower limit of ten probes for an aceeptable lesson, and in addition required that the lesson be of "superior" educational quality in all other respects. The latter decision was based on two sets of judgments. At the conclusion of each demonstration tape, the students filled out the Stanford Teacher Competence Appraisal Guide, an instrument that provides student evaluations across thirteen teacher behaviors on an eight point scale.[2] In addition, the investigators subjectively assessed the general educational quality of the tape.

The models typically taught the same lesson three times. During each demonstration, the senior investigator recorded the number of probes that occurred and noted suggestions for improvement. In the period between tapes, the investigator and the model replanned the lesson. In all, eleven models received training. From this pool, the best seven tapes were selected. Model characteristics are summarized in Table 4. (See Table 4, Experiment III) It should be noted that the same female model was shown to female science and mathematics

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[2] Pupils rated the model on an eight-point scale in terms of the following areas of competence; aims, planning; performance; evaluation. The lowest mean score a teacher could receive would be 0. The highest possible mean score would be 77.

subjects. The lesson dealt with simple probability notions in Science and was thus applicable to Mathematics. Eleven subjects viewed perceptual models who demonstrated probing in subject-matter areas other than the intern's major area. This was due to the fact that there were so few interns in certain subject-matter areas (Drama, Art, P.E.) that models were not trained. The sex of the model they were exposed to was however controlled.

Measurement Procedures: During the study, each of the intern's lessons were recorded on videotape for later analysis. The relevant behaviors were recorded by four raters trained for this purpose. Prior to the analysis of the tapes in the current experiment, the raters had been trained, and had rated approximately 400 twenty-minute tapes for another experiment (Allen, McDonald and Orme, 1966). The dependent variable in this earlier study involved basic questioning techniques that included probing among other things. Thus, the retraining phase for the current analysis was relatively brief. The raters retrained on non-experimental tapes first, then rated the model tapes until perfect agreement was reached. All experimental tapes were then rated by two independent raters. Raters neither knew the treatment conditions nor the sequence of the tapes in training for intern tapes being rated. Operators played the tapes for raters in a previously determined random sequence. The reliability data reported in Table 5 (See Table 5, Experiment III) are based on all of the tapes used in the study. Since the tapes were only five minutes long, it was possible to obtain two independent ratings on each tape. The coefficients are therefore based on double ratings of 297 intern tapes (6 tapes had been omitted prior to rating because of inadequate audio or visual quality).

Rater reliability on the probing sub-categories as compared with the Allen, McDonald, and Orme (1966) study is higher. This reflects the attention given in retraining to sharpening the operational definitions of the relevant behaviors.

Results

Two basic distinctions have been made about probing as dependent variable in an earlier paper by Allen, McDonald and Orme (1966). First, each of the response categories of probing act as discrete dependent variables. This inter-variable independence is shown in Table 5. (See Table 5, Experiment III) Of all of the possible intercorrelations between the eight response categories, only one (prompting/clarification, r = .31) is significantly different from zero.

It follows that in the analysis for treatment effects, one can expect differential levels of significance on different variables in each session. A consideration of probing as a category provides an overall test for the combined effects of all of the dependent variables for a given trial or session.

The second relevant distinction to be made about probing is that there is a definite ceiling effect on its frequency of occurance in classroom interaction. In looking for overall effects then, it is more meaningful to consider probing in relation to non-probing or total teacher responses, then to focus exclusively on measures of probing alone. This type of analysis along with analyses of covariance will be presented for both modeling and feedback treatment differences.

Modeling Effects: The basic assumption tested here was that the rate and level of learning varies as a function of mode of model presentation. The six experimental groups had been ordered in terms of theoretical expectations outlined earlier. It was predicted that Group 1 subjects would emit the lowest number of probes following treatment, and that Group 6 subjects would emit the greatest number of probes.

Taking ceiling effects into account, the primary analysis for modeling effects involved an analysis of Probing in relation to non-probing responses so that overall effects could be ascertained. First, probing and non-probing mean frequencies by trial and group were placed on an equivalent scale by dividing each session mean by the pretest mean. Mean probes and non-probes were then plotted against each other for each group in the second session (session 2 scores are based on the immediately prior modeling treatement). This yielded a single coordinate for each group on trial 2, which expressed the increase in probing in relation to non-probing, and in a manner analagous to covariance, took account of initial differences in performance on the pretest. The distance of each coordinate from the origin was then determined, and these projections were fitted to the best fit line (Yp, np = 2.75 x 5.0).

This yielded a graphical representation of the order effects produced by modeling treatment when probing and non-probing are considered together (see Figure 1, Experiment III) The probability of achieving the hierarchical ordering illustrated in Figure 1 by chance is .0083.

As can be seen, the effect of the treatments conformed with theoretical expectations, except that Group 4 (strong symbolic, minimal perceptual modeling) subjects performed below expectation while Group 3 (minimal perceptual modeling) performed somewhat above. The

differences between these groups become more pronounced in trial 3. Figure 2 illustrates the above relationship in terms of unadjusted means.

Treatment differences were also analyzed by performing analyses of covariance, with trial one scores as the covariants, on trial 2 scores. These data are summarized in Table 6 (See Table 6, Experiment III) which presents differences between groups in trials 2 and 3, and in Table 7, (See Table 7, Experiment III) which summarizes specific differences between groups within each trial.

These results provide more specific information about the modeling differences found in the primary analysis of probes in relation to non-probes. The experimental group differed significantly (Table 6) in the use of refocus procedures ($p < .05$) as a result of differential modeling treatments, and also tended to differ in terms of total pupil responses ($p < .10$), redirection ($p < .25$), prompting ($p < .25$) and as seen before, in probing ($p < .25$). The latter probability level is predictably lower than the first analysis would suggest, since probing in the covariance analysis is not considered in relation to non-probing or total teacher responses.

Table 7 (See Table 7, Experiment III) presents covariance results on a between-group difference for specific experimental groups. These data do not strongly support specific hypotheses related to modeling effects. Minimal perceptual modeling (Group 3) does appear to be superior to minimal symbolic modeling (Group 1) in terms of refocus, but these differences are not great enough to reach significance by the end of trial 2. Similarly maximal perceptual modeling (Group 5) tends (p .10) to be superior to maximal symbolic modeling (Group 2) for probing in general, but the relatively low F ratios do not permit one to make firm conclusions about these trends.

Feedback Effects: The same type of discriminant analysis as that first performed to clarify modeling effects was repeated for feedback results. Procedures were identical to those outlined earlier, except that trial 3 scores were equated by using trial 2 scores. The results for feedback effects were quite different. Figure 3 (See Figure 3, Experiment III) shows that while confirmation, prompting and combined feedback treatments produced the kinds of effects predicted earlier, The self feedback group performed well beyond expectation. This is surprising when one considers that the self -feedback group in the McDonald, Orme and Allen (1966) study moved in the opposite direction.

Figure 4 provides a clear illustration of the differential effects of the four types of feedback. The data in this figure are derived from covariance means since trial 1 scores are not needed. The covariance adjustment in this case includes both trial 1 and trial 2 scores so that the effects of prior experience and modeling effects are controlled. This is also the case for Tables 6 and 7 (See Tables 6 and 7, Experiment III) where treatment differences based on feedback conditions are presented.

The greatest differences between feedback treatments were expressed in the case of clarification. Group 5 (Prompting Feedback) and Group 6 (Combined Prompting and Confirmation Feedback) used clarification significantly more frequently than did Group 4. Indeed, on this variable, Group 3 subjects achieved higher scores than did the Group 4 subjects.

Finally, training differences, i.e., significant differences within a given group from trial to trial are reported in Table 8. (See Table 8, Experiment III) Significance levels for probes effectively summarize those response categories other than pupil responses. As can be seen, Groups 5 and 6 demonstrate the greatest gains. These data are very consistent with the analysis for modeling effects. The hierarchial ordering from Group 6 down to Group 1 is prominent.

Discussion of Results

The distinctiveness of the order effect and the consistent nature of trends in favor of perceptual modeling conditions would indicate that perceptual modeling is superior to symbolic modeling. However the lack of significance between treatments means does not permit a firm conclusion.

The most clear-cut differences occurred between minimal and symbolic and perceptual modeling. When discrimination training was added to the different modeling conditions, these differences were somewhat obscured. This suggests that probing may be a skill that can be acquired effectively through symbolic modeling procedures without requiring the distinctive cueing properties of perceptual modeling. The written instructions provided in step 2 of treatment precisely described what was required, and since these verbal responses were in the subjects' repertoires before training began, it is possible that the significant gains in probing for all groups from trial 1 to trial 2 (see Table 8, Experiment III) simply represent a performance jump rather than the acquisition of new behavior.

It is equally clear, however, that the training efficiency of perceptual models is considerable. The ease with which it was possible to "set" the desired behavior using model

tapes in training can be inferred from the results in Table 8. Training differences inGroups 5 and 6 are more consistently significant across all response categories than is the case for the other groups. The amount of effort and finesse required of a supervisor under symbolic modeling conditions was quite different from that required under perceptual modeling conditions. In the former, the amount of effort expended in relation to learner gain was generally greater.

TABLE 1

(Exp. III)

SUMMARY OF STEPS IN TREATMENT BY EXPERIMENTAL GROUP[1].

	Step	Treatment Given	Experimental Group Number I	II	III	IV	V	VI	Time in Treatment
Treatments	1	Teach(Pretest)	X	X	X	X	X	X	5 minutes
	2	Set Induction	X	X	X	X	X	X	20 minutes
	3	View of Self	A	E	A	E	A	E	10 minutes
	4	View the Model	R	R	A	A	E	E	10 minutes
	5	Plan Next Lesson	X	X	X	X	X	X	10 minutes
	6	Teach	X	X	X	X	X	X	5 minutes
Treatments	7	View the Self	A	E	A	E	A	E	10 minutes
	8	View the Model	R	R	A	A	E	E	10 minutes
	9	Plan Next Lesson	X	X	X	X	X	X	10 minutes
	10	Teach(Post-test)	X	X	X	X	X	X	5 minutes

[1]Explanation of Symbols:

(X) Indicates that the subject received this treatment;

(A) indicates that the subject views a playback of his own performance alone, or else viewed the perceptual model alone;

(E) indicates that the subject viewed the tape concerned with the experimenter and thus received discrimination training and reinforcement from him;

(R) indicates that the subject restudied the written materials describing the criterion behavior.

TABLE 2

(Exp. III)

SUMMARY OF MODELING AND FEEDBACK PHASES OF TREATMENT BY EXPERIMENTAL GROUP

Group Number	Phase of Treatment	
	Modeling (Steps 3 and 4)	Feedback (Steps 7 and 8)
I	Minimal Symbolic Modeling	----------
II	Maximal Symbolic Modeling	----------
III	Minimal Perceptual Modeling	Self-Feedback
IV	Strong Symbolic Minimal Perceptual	Confirmation Feedback
V	Maximal Perceptual Modeling	Prompting Feedback
VI	Strong Symbolic, Maximal Perceptual Modeling	Confirmation and Prompting Feedback

TABLE 3
(Exp. III)

AGE, SEX, SUBJECT-MATTER DATA FOR THE EXPERIMENTAL POPULATION

N=303

Group Number	N	Mean Age	Sex		Subject-Matter Major						
			Male	Female	Eng.	Soc. St.	Math	Sc.	P.E.	Art	Drama
I	17	24.5	3	14	7	6	0	2	0	1	1
II	17	24.4	8	9	7	6	0	3	1	0	0
III	16	23.9	8	8	7	8	1	0	0	0	0
IV	17	24.0	5	12	5	6	1	4	1	0	0
V	17	23.2	5	12	5	7	1	3	0	1	0
VI	17	24.1			5	5	1	5	1	0	0

TABLE 4
(Exp.III)

SALIENT CHARACTERISTICS OF THE PERCEPTUAL MODELS USED IN THE STUDY

Model Number	Sex of Model	Subject Taught	Probes per Tape	No-Probes per Tape	Appraisal Guide Mean Score(a)
1	Male	Soc. Studies	15	6	58.2
2	Male	English	25	11	59.2
3	Male	Math	11	6	60.0
4	Male	Science	17	8	61.2
5	Female	Soc. Studies	19	5	63.0
6	Female	English	18	7	62.8
7	Female	Math	17	9	57.0
8	Female	Science	17	9	57.0

TABLE 5

(Exp.III)

RELIABILITY COEFFICIENT BASED ON 297
VIDEOTAPES RATED BY TWO INDEPENDENT OBSERVERS

Response Category	Reliability Coefficient
Total Pupil Responses	0.9935
Total Pupil Probes	0.9935
Total Teacher Non-Probes	0.9910
Total Teacher Reinforcement	0.9828
Probing Sub-Categories:	
a. Clarification	0.9793
b. Critical Awareness	0.9338
c. Redirection	0.9647
d. Prompting	0.9159
e. Refocus	0.8645

TABLE 6

(Exp.III)

CORRELATION MATRIX FOR THE MAJOR RESPONSE CATEGORIES

OF THE DEPENDENT VARIABLE

N=277

	NPr	AQ	TNR	Pr	Cl	CA	Rd	Pmt	Rf	EA	PS	RP
T. No Probes (TNR)	1.00	.3421	.6551	.1237	.0814	.1789	-.0734	.1060	.0083	-.0587	-.0154	.0263
Answers Questions (AQ)		1.00	.1775	-.1152	-.1392	.0030	-.1270	-.0016	-.0510	-.0359	-.0051	.0096
No Response or says Wrong (NR)			1.00	.1830	.1295	.1305	-.0808	.1673	.1472	-.0174	-.0247	.0414
Probes (Pr)				1.00	.8517	.4966	.4154	.5635	.3368	.1425	-.0642	-.0843
Clarifies (Cl)					1.00	.1614	.1367	.3084	.1763	.1321	-.0509	-.0946
Critical Awareness (CA)						1.00	.1899	.1127	.1416	-.0129	-.0172	-.0069
Redirect(Rd)							1.00	.1898	.0669	.0962	-.0219	-.0709
Prompt (Pmt)								1.00	.1660	.0910	-.0574	-.0080
Refocus (Rf)									1.00	.0393	-.0546	.0546
Encouraging Alternatives (CA)										1.00	-.0051	-.0048
P. Summary (PS)											1.00	-.0069
Role Play (RP)												1.00

NOTE: In order for any of the coefficient reported above to be considered significantly different from o, r must = .195 (p = .05) or .254 (p = .01)

TABLE 7

(Exp.III)

SUMMARY OF TREATMENT DIFFERENCES DERIVED FROM THE ANALYSES OF COVARIANCE FOR SESSION TWO (SESSION ONE SCORES AS COVARIATES), AND SESSION THREE (SESSION ONE AND TWO SCORES AS COVARIATES) FOR THE SIX EXPERIMENTAL GROUPS[1]

Dependent Variables	Session 2		Session 3	
	F Ratio	df	F Ratio	df
Total Pupil Responses	2.134[b]	5/88	0.667	5/77
Intern Reinforces Pupil	0.716	5/88	1.420[a]	5/77
Probing	1.383[a]	5/88	1.091	5/77
Clarification	0.582	5/88	2.466*	5/77
Critical Awareness	1.002	5/88	0.774	5/77
Redirection	1.806[a]	5/88	0.367	5/77
Prompting	1.623[a]	5/88	0.443	5/77
Refocus	2.771	5/88	2.008[b]	5/77
Encouraging Alternatives	(Frequence of Occurance Too Low To			
Pupil Summary	Permit meaningful analysis)			
Role Play				

[1] Level of Significance: a:F (5/88; 5/77) = 1.35, $p < .25$
b:F (5/88; 5/77) = 1.90, $p < .10$
*:F (5/88; 5/77) = 2.29, $p < .05$

TABLE 8
(Exp.III)

THE T STATISTIC RESULTS FOR BETWEEN-GROUP DIFFERENCES BASED ON THE ANALYSES OF COVARIANCE FOR SESSIONS TWO AND THREE

Dependent Variables	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
	Direction of the Difference and Level of Significance					
	MODELING EFFECTS - SESSION TWO					
Total Pupil Responses	NS	NS	NS	$G_4 > G_1$ ($p>.10$)	$G_5 > G_1$ ($p<.10$) $G_5 > G_2$ ($p<.10$)	$G_6 > G_1$ ($p<.10$) $G_6 > G_2$ ($p<.10$) $G_6 > G_3$ ($p<.10$)
Probing	NS	NS	NS	$G_4 > G_1$ ($p<.25$)	$G_5 > G_1$ ($p<.25$)	$G_6 > G_1$ ($p<.10$) $G_6 > G_2$ ($p<.10$)
	FEEDBACK EFFECTS - SESSION THREE					
Clarification	NS	NS	NS	NS	$G_5 > G_4$ ($p<.05$)	$G_6 > G_1$ ($p<.05$) $G_6 > G_2$ ($p<.05$) $G_6 > G_4$ ($p<.05$)
Refocus			$G_3 > G_1$ ($p<.10$)			

TABLE 9
(Exp.III)

WITHIN-GROUP TRAINING DIFFERENCES BASED ON UNADJUSTED MEANS, COMPARED BY MEANS OF THE T STATISTIC

Dependent Variables	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
	Direction of Difference from Trial to Trial					
Total Pupil Responses	$T_3>T_1$ (.01)	$T_3>T_1$ (.05) $T_2>T_1$ (.05)	$T_3>T_1$ (.01) $T_2>T_1$ (.05)	$T_3>T_1$ (.01) $T_2>T_1$ (.01)	$T_3>T_1$ (.01) $T_2>T_1$ (.01)	$T_3>T_1$ (.01) $T_2>T_1$ (.01)
Intern Reinforces Pupil	NS	NS	NS	$T_3>T_1$ (.05) $T_2>T_1$ (.05)	$T_3>T_1$ (.05) $T_2>T_1$ (.05)	$T_3>T_1$ (.05) $T_3>T_1$ (.05)
Total Probes	$T_3>T_1$ (.05)	$T_3>T_1$ (.01) $T_2>T_1$ (.05)	$T_3>T_1$ (.01) $T_2>T_1$ (.05)	$T_3>T_1$ (.01) $T_2>T_1$ (.01)	$T_3>T_1$ (.01) $T_3>T_1$ (.01)	$T_3>T_1$ (.01) $T_3>T_1$ (.01)
Clarification	NS	$T_2>T_1$ (.10)	$T_3>T_1$ (.01) $T_2>T_1$ (.10))	NS	$T_3>T_1$ (.01) $T_2>T_1$ (.05)	$T_3>T_1$ (/01) $T_3>T_1$ (.01)
Critical Awareness	NS	$T_2>T_1$ (.10)	NS	NS	$T_2>T_1$ (.10)	$T_3>T_1$ (.01) T_2 T_1 (.05)
Redirection	NS	$T_3>T_1$ (.05)	$T_3>T_1$ (.10)	$T_2>T_1$ (.05)	$T_2>T_1$ (.10)	$T_3>T_1$ (.10)
Prompting	NS	$T_3>T_1$ (.10)	$T_3>T_1$ (.10) $T_2>T_1$ (.10)	$T_3>T_1$ (.05)	$T_3>T_1$ (.10) $T_2>T_1$ (.10)	NS
Refocus	NS	NS	$T_3>T_1$ (.10)	NS	NS	$T_3>T_1$ (.01) $T_2>T_1$ (.05)

Experiment III: Effects of Modeling
(Session Two)

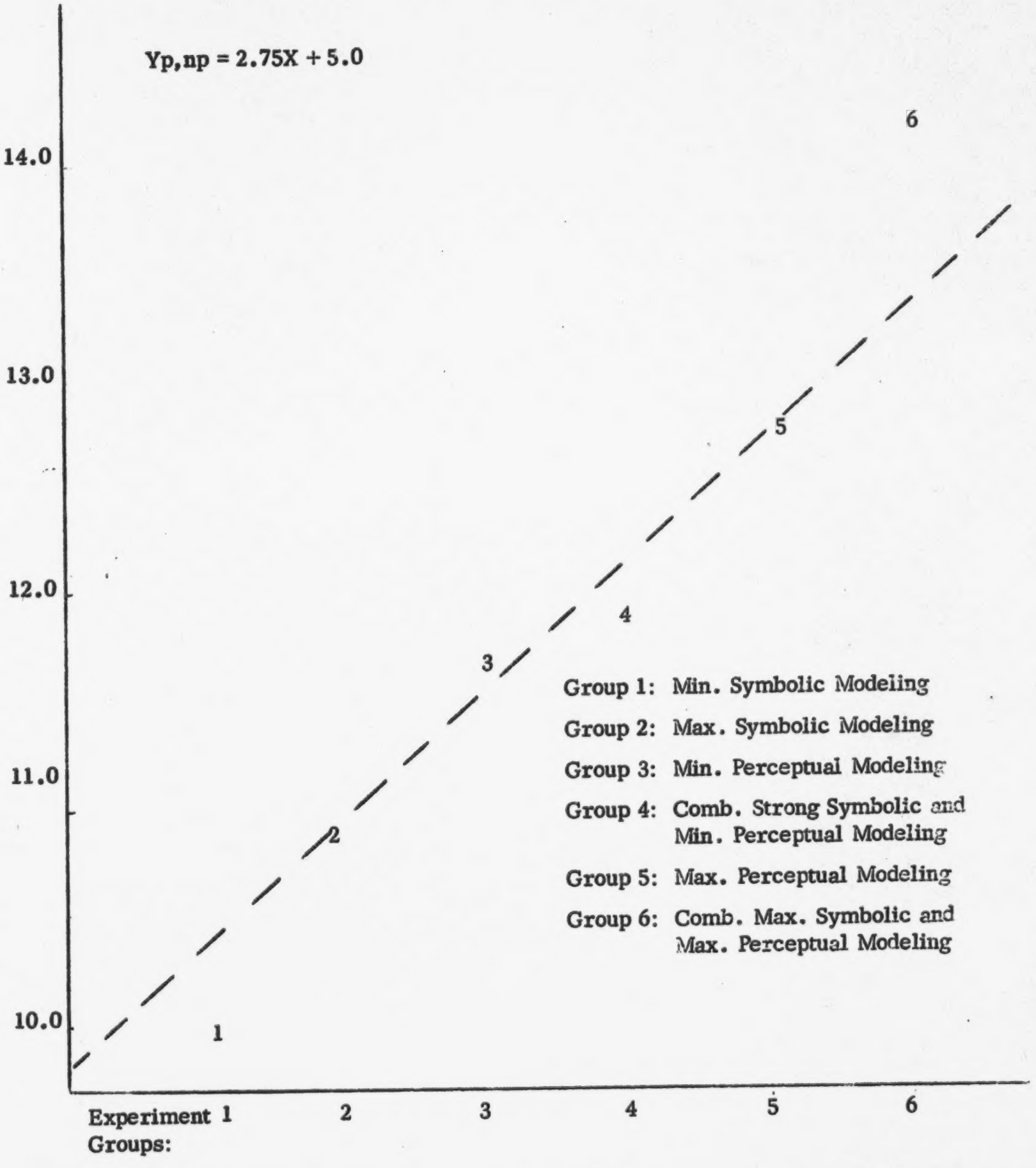


FIGURE 1. The ordering of modeling effects when group trends occurring in each of the dependent variables are taken together and plotted against non probing teacher esponses.

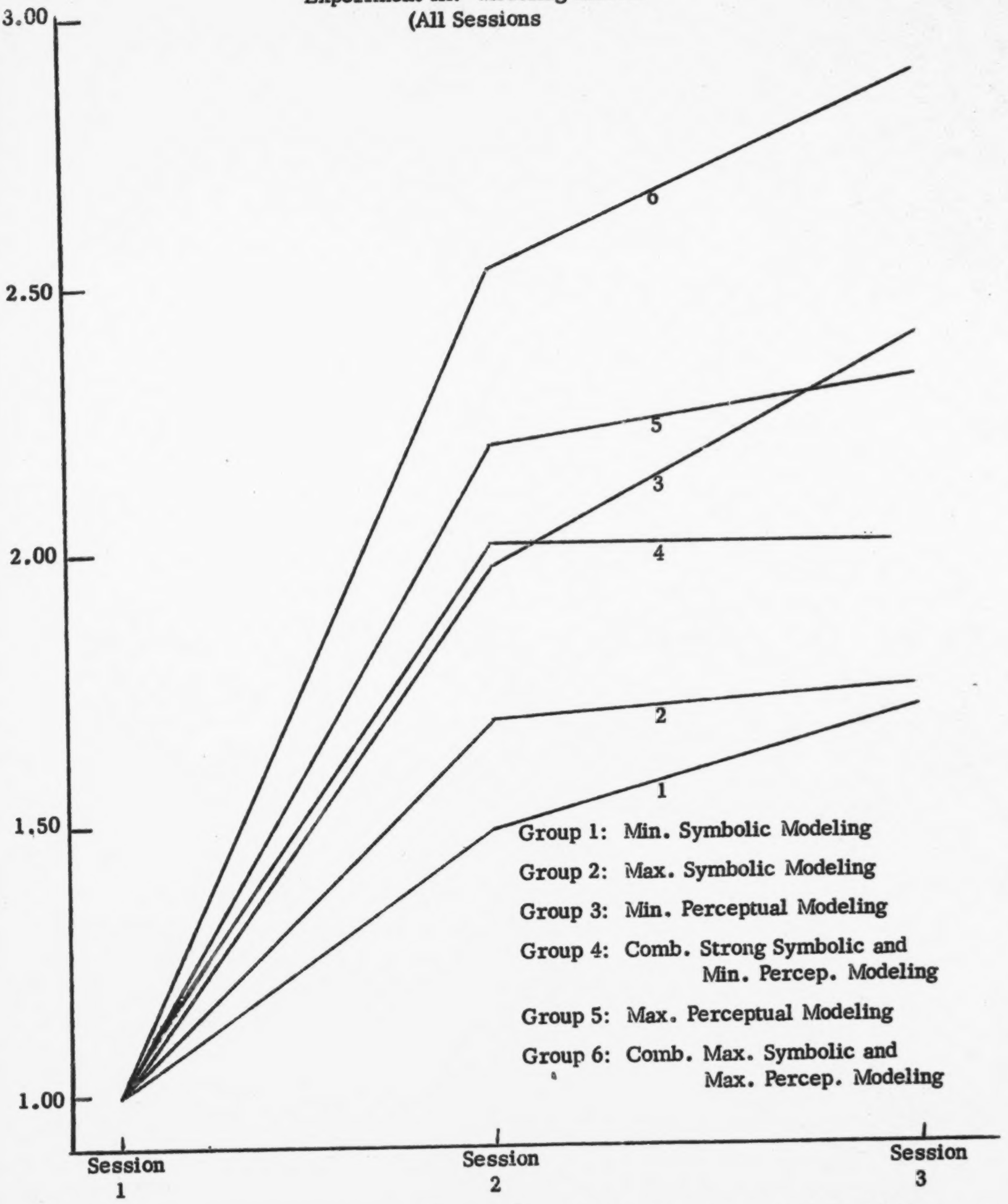
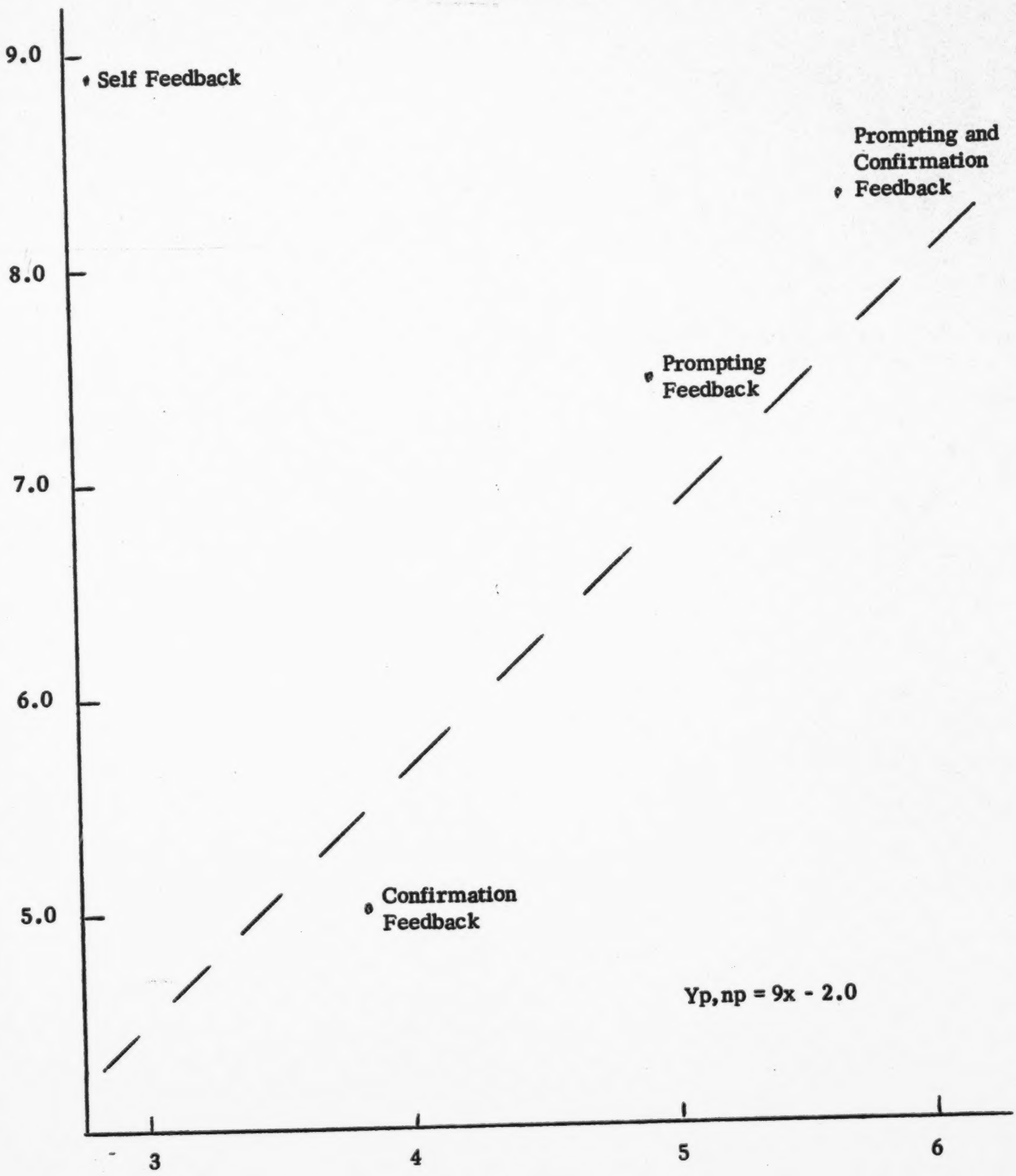


FIGURE 2. Unadjusted mean frequencies of Probing brought to a common origin by dividing the mean frequencies for each session by the first session mean.

Experiment III: Feedback Effects
(Session Three Only)



Experiment III

Feedback Effects (Session 3)

FIGURE 4. Analysis of covariance probing means adjusted for prior effects in trials 1 and 2, and illustrating feedback effects.